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Tracking Electronic Pathways in Energy Materials by Low Voltage Scanning Electron Microscopy

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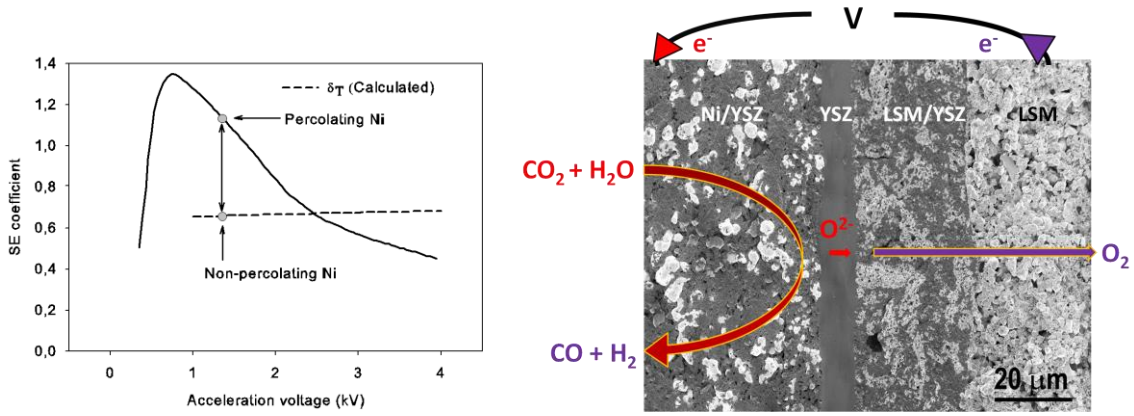
Electrodes for energy conversion devices such as solid oxide fuel cells (SOFC) and electrolysis cells (SOEC) commonly consist of mixtures of electronically and ionically conducting ceramic and metallic materials in order to transport electrons and facilitate charge transfer to/from the electrolyte. For optimal performance it is paramount that the electronically conducting phases are well interconnected throughout the electrodes to create the required electronic connection from the electrolyte to the external circuit. Applying low voltage scanning electron microscopy and surface potential contrast [1] (Fig. 1a) the interconnected electronic pathways within the electrodes can be tracked (Fig. 1b) and evaluated. Examples of evaluation of microstructures resulting from different processing and performance degradation phenomena will be presented.



a **b**

Figure 1: a) Secondary electron coefficient for Ni as a function of acceleration voltage illustrating the contrast mechanism; b) Example of tracking the electronic pathways in both electrodes of a solid oxide electrolyzer cell.

[1] K. Thydén, Y.L. Liu and J.B. Bilde-Sørensen, *Solid State Ionics* **178**, 1984–1989 (2008).